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Ahlstrom, V. and Muldoon, R. (2003). *Menus and Mnemonics in Airway Facilities (Report No. DOT/FAA/CT-TNO3/12).* Atlantic City, NJ: William J Hughes Technical Center. (DTIC No. ADA417141)

http://handle.dtic.mil/100.2/ada417141

Abstract: This study examines the use of menus and mnemonics in current Airway Facilities (AF) systems and compares them to human factors guidelines and best practices. Researchers from the William J. Hughes Technical Center traveled to AF field sites and collected data on the menus and mnemonics for the systems in use. The researchers extracted human factors guidance on menus and mnemonics from the literature and surveyed current commercial software. Using this information, they identified commercial standards for menu structure, terminology, mnemonics, options, and organization. They compared current AF systems against this information and developed recommendations for the design of future systems.

Allen, E. C., and Nalepka, J. P. Duquette, M. M. and Leen, M. J. (2003). *Development and Applications of Large Number of Air Vehicles Simulation (LNAVSIM) Software (Report No. AFRL-VA-WP-TP-2003-314).* Wright-Patterson AFB, OH: Air Force Research Lab Air Vehicles Directorate. (DTIC No. ADA416426)

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Abstract: The U.S. Air Force is investigating ways to study the utilization of large numbers of air vehicles (LNAV), such as UAVs and UCAVs, to locate strategic targets, provide battlefield situational awareness, and deliver first-wave firepower. The Large Number of Air Vehicles Simulation (LNAVSIM) is addressing the Air Force's requirements by providing the user an automated, PC-based, Internet compatible, and GUI interactive, mission planning, modeling, assessment, and simulation environment to conduct LNAV command and control studies. It consists of the integration of critical technologies for the application of LNAV target allocation, autorouting, in-flight replanning and swarm management techniques. Several separate software components comprise the LNAVSIM suite.

Arambel, P. O., Lavely, E. and Landau, H. (2003). *Performance Prediction Model for Road-Constrained Multiple Target Tracking.* Burlington, MA: ALPHA Tech Inc. (ADA416486)

Abstract: The performance of tracking systems depends on numerous factors including the scenario, operating conditions, and choice of tracker algorithms. For tracker system design, mission planning, and sensor resource management, the availability of a tracker performance model (TPM) for the standard measures of performance (MOPs) would be of high practical value. Ideally, the TPM has high computational efficiency, and is insensitive to the particular low-level details of highly complex algorithms and important operating conditions. These characteristics would eliminate the need for high fidelity Monte Carlo simulations that are expensive and the consuming. In this paper, we describe a performance prediction model that generates track life distributions and other MOPs. The model employs a simplified Monte Carlo simulation that accounts for sensor orbits, sensor coverage, target dynamics. A key feature is an analytical expression that approximates the probability of correct association (PCA) among reports and tracks. The expression for the PCA that we use was developed by Mori et al. for simplified scenarios where there is a single class of targets, the noise is Gaussian, and the covariance matrices are identical for all targets. Based on heuristic considerations, we extend this result to the case of road- constrained tracking where both on-road and off-road targets are present. We investigate the validity of the proposed expression by means of Monte Carlo simulations, and present preliminary results of a validation study that compares the performance of an actual tracker with the performance predictions of our model.

Cardosi, K. (2003). *Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment (Report No. DOT-VNTSC-FAA-02-11).* Cambridge, MA: John A Volpe National Transportation Systems Center. (DTIC No. ADA417122)

Abstract: This document describes human factors challenges that need to be considered in the implementation of planned enhancements to the Standard Terminal Automation Replacement System (STARS), Common Automated Radar Terminal System (ARTS), and the ARTS Color Display (ACD) in the Terminal Radar Approach Control (TRACON) environment. Some of the enhancements are tools that have been developed specifically to increase efficiency and capacity. Others provide information (regarding weather or aircraft position) that is more precise than the information currently available to controllers. The scope is limited to the air traffic control (ATC) specialist's workstation and specifically excludes Airways Facilities and Air Traffic Management issues. Issues are discussed within the TRACON environment and between environments, where applicable. The intent of this document is

to pave the way for successful future integration efforts by identifying issues that need to be considered in the implementation process.

Chan, H. P. (2003). *Development of a Digital Stereoscopic Imaging Technique in Mammography.* Ann Arbor, MI: University of Michigan. (DTIC No. ADA416976)

http://handle.dtic.mil/100.2/ada416976

Abstract: The goal of this research is to develop stereoscopic techniques for mammographic imaging and to investigate the feasibility of using stereomammography to improve the sensitivity of mammography for breast cancer diagnosis. During the project years we have performed extensive investigation of the effects of image acquisition techniques including stereo shift, exposure, and geometric magnification on the depth discrimination capability of digital stereomammography. Software tools have been developed for two high-resolution stereo display workstations. The software allows manipulation of the displayed images and provides 3D virtual cursors for the measurement of the depth of a lesion in the image. Observer experiments have been performed to evaluate the stereomammography imaging technique using stereo images of a specially designed 3D modular phantom. A database of stereo images of biopsied breast tissue specimens was collected and observer performance experiments were conducted to compare the accuracy of lesion haracterization and margin clearance identification on stereoscopic and monoscopic images. A pilot study was performed to compare radiologists' impressions of full field digital stereomammograms with conventional mammograms obtained from informed consent breast cancer patients. The results of this project indicate that stereomammography is technologically feasible and it is a promising technique that will provide additional 3D information for the detection and characterization of breast lesions. Further studies are therefore warranted to investigate whether stereomammography can improve the sensitivity of mammography for breast cancer detection, especially in dense breasts.

Chin, D. N. and Crosby, M. E. (2003). *The Effectiveness of User Models in Reducing Cognitive Load.* Honolulu, HI: Hawaii University at Manoa. (DTIC No. ADA416505)

http://handle.dtic.mil/100.2/ada416505

Abstract: We strive to improve human performance through the adaptive filtering of information. The research results will help guide the design of future crisis/battlefield management interfaces. Our experiments show: (1) eye fixations can be used as a measure of cognitive load in simple visual search tasks, (2)

hand and finger pressures on a mouse indicate cognitive load in target selection tasks, (3) mouse click signatures can be used for continuous identity verification, (4) nested objects are significantly more difficult to count than adjacent objects, (5) performance decreases significantly with both map complexity and task complexity, (6) up to three static distracters make no difference in map route finding performance, (7) increasing numbers of moving distracters decreases map route finding performance, (8) having one distracters at a time move makes no difference in map route finding performance, (9) judgment of ratios is significantly easier when presented two-dimensionally rather than linearly, (10) training in one graphic data model style does not transfer to other graphic styles.

Doane, S. (2003). *Relating Memory Processes to Aviation Flight Situation Awareness Abilities.* Mississippi State, MS: Mississippi State University. (DTIC No. ADA417024)

http://handle.dtic.mil/100.2/ada417024

Abstract: The purpose of this research was both applied and theoretical. From an applied perspective, we sought to develop new tests of cognitive abilities that would be related to later flight situation awareness (SA) performance, to relate the new measures to existing measures of cognitive ability, and to give the new measures to the Navy for further investigation as personnel classification tools. This research also sought to expand the classification tools available to identify aviators with high SA abilities. By improving such identification, the ability to match personnel skills and cognitive demands of occupations requiring SA will be enhanced. From a theoretical perspective, this research was designed to improve our understanding of the cognitive abilities required to gain and maintain flight SA, and in so doing to provide a more precise definition of the SA construct. In addition, we intended to address the impact of stress on Navy student and expert pilot WM, LTWM, and flight SA abilities and to focus on the development and test of internal and external validity for three new measures of flight SA ability. These goals were supposed to be accomplished during years 2 and 3 of the project. Funding ended after the first year, which meant the additional goals, could not be addressed.

Doane, S. and Moorhead, R. (2003). *Virtual Environments and Virtual Interfaces for Oceanographic and Meteorological Scientific Visualization.* Mississippi State, MS: Mississippi State University. (DTIC No. ADA416542)

http://handle.dtic.mil/100.2/ada416542

Abstract: This research examined potential ways to optimize meteorological and oceanographic (METOC) analyst training and performance during mine counter measure (MCM) operational tasks. Virtual environments (VEs) and virtual interfaces were used as tools that support comprehension of sedimentation transport data. Novel techniques were developed for the visualization of sedimentation transport data. An interface for the visualization was also developed based on a cognitive task analysis of a sedimentation transport expert. In addition, three experiments were designed to examine the cognitive aspects (spatial cognition and comprehension of oceanographic data) of immersive VEs. The results revealed individual differences in the way people represent objects in space as they navigate in a VE and these differences have an impact on VE usability. As the level of immersion in the VE increased, scientists required more time and more hints to comprehend remotely sensed oceanographic data. The implications of these results are discussed.

Doktor, R. H. and Bangert, D. (2003). *Human Factors in Telemedicine.* Honolulu, HI: Bangert/Doktor Inc. (DTIC No. ADA416637)

http://handle.dtic.mil/100.2/ada416637

Abstract: To bring together some of the best minds in the field of Human Factors as it relates to Telemedicine. The group will explore how the utilization rates can be improved and document the thinking in the form of a book that will be valuable to the military health care system and to scholars. Bangert/Doktor, Inc. will manage a virtual learning community that interacts continually for two years using the Internet and attends two meetings sponsored by TATRC, devoted to the theme Human Factors in Telemedicine. At the first meeting the invitees will explore general topics and discuss their individual "thought pieces." They will have an opportunity to react to each other's ideas. Between the meetings, the invitees will refine and prepare their articles. At the second meeting, final drafts will be exchanged and discussed. Dominant themes identified. The editors will then finalize the articles, organize the edited edition, and prepare the necessary introductory and conductive passages. Bangert/Doktor, Inc. will review designated TATRC-sponsored projects and present conclusions pertaining to human factors issues inherent in each project.

Frink, D. D. and Ferris, G. R. (2003). *Personal and Structural Influences on Performance in Dynamic Environments: An Investigation of Social Skill/Intelligence and Social Contingencies.* Oxford, MS: University of Mississippi. (DTIC No. ADA416400)

Abstract: Research was conducted for clarifying linkages among individual differences in social skill/intelligence constructs, contextual differences in social contingencies (i.e., accountability mechanisms), and performance outcomes. Research suggests that social intelligence may offer relatively high validities for performance prediction, while accountability has consistently shown to be a determinant of behavior, interacting with personal and contextual characteristics. Furthermore, the social contingency nature of accountability (both formal and informal) provides a conceptual linkage with social intelligence, suggesting there should be interactions of these constructs on performance. A multi-study approach was used to develop a measure of social skill in organizations, to demonstrate convergent and discriminate validity for multiple measures of the social skill construct, and to advance understanding of how individuals differing in social skills respond to differing accountability perceptions in terms of performance. First, the psychometric properties of multiple measures of social skill/intelligence were analyzed relative to potentially related dispositional constructs. Specifically, measures of emotional intelligence, political skill, and Self-Monitoring was gathered from student subjects, along with personality constructs of Conscientiousness and Locus of Control to assess both convergent and discriminate validity of these measures in a performance context. Second, a laboratory experiment approach extended this survey approach into a performance context. Third, a field study was used to replicate and extend the relationships supported in the preceding studies in an organization, using standard and contextual performance measures. Finally, another field study extended these findings into an organizational context, examining the interaction of social skill and accountability on desirable organizational performance.

Gowdy, V. and DeWeese, R. (2003). *Human Factors Associated With the Certification of Airplane Passenger Seats: Life Preserver Retrieval (Report No. DOT/FAA/AM-03/9).* Oklahoma City, OK: Federal Aviation Administration - Civil Aeromedical Institute. (DTIC No. ADA417209)

Abstract: A series of human subject tests were conducted by the Biodynamics Research Team at the FAA's Civil Aerospace Medical Institute (CAMI) to investigate human factors associated with the "easy reach" requirement in FAA regulations for under-seat mounted life preservers. The protocol was designed to observe and measure the effects of human physical attributes and life preserver installation features relevant to the retrieval of life preservers. A mockup of a 30-inch pitch, economy class transport passenger seat installation was used to evaluate 4 configurations of life preserver installations. The

position of the pull-strap, used to open the life preserver container, was the independent variable. One hundred thirty-two adult subjects were tested. Each subject was seated, restrained by the seat's lap belts, instructed to reach beneath the seat, open the lifer preserver container, and extract the packaged life preserver. The time for retrieval of the life vest was measured from videotapes of each test. The videotapes were also reviewed independently by 11 outside raters, who rated the difficulty for each subject on a scale of 1 (easy) to 7 (very difficult). There was significant agreement (Cronbach's alpha = 0.978) in the "ease" ratings. In comparing the ease ratings and retrieval times, an average ease rating < 3 corresponded to a retrieval time < 10 seconds. An "EASY10" benchmark, derived from these results, indicates that a life preserver retrieval time < 10 seconds should be considered easy. Two of the configurations had average ratings < 3. The installation features that distinguish the two configurations that passed the EASY10 benchmark, compared with the two that failed, were the position of the pull-strap, the pull-angle on the strap necessary to effect a quick opening of the life preserver container, and the position of the stowed life preserver relative to the front frame of the seat.

Koros, A., Rocco, P. S., Panjwani, G., Ingurgio, V. and D'Arcy, J. F. (2003). *Complexity in Air Traffic Control Towers: A Field Study. Part 1. Complexity Factors (Report No. DOT/FAA/CT-TN03/14).* Atlantic City, NJ: Federal Aviation Administration Technical Center. (DTIC No. ADA417199)

http://handle.dtic.mil/100.2/ada417199

Abstract: This study investigated factors that contribute to complexity and their incidence within Federal Aviation Administration Air Traffic Control Towers (ATCTs). Human Factors Specialists from the William J. Hughes Technical Center selected six sites representing a combination of high traffic volume, traffic mix, and/or converging runways. Sixty-two Air Traffic Control Specialists (ATCSs) from the six ATCTs rated 29 complexity factors from local and ground controller perspective. The relative contribution of each of the complexity factors was site- and position-specific. High traffic volume, frequency congestion, and runway/taxiway configuration were among the leading complexity factors at all sites and for both control positions. This study characterized the differences between facilities in terms of the key factors and their incidence and summarized the interview data describing the nature of the complexity. An enhanced understanding of ATCSs' decision making and tower complexity factors will help researchers predict the impact of automation and emerging technologies on controllers and ensure the continued safety and efficiency of the National Airspace System.

Mesick, H. C., McCreedy, F. P. and Harris, M. M. (2003). *A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates (Report No. NRL/MR/7440-03-8299)*. Stennis Space Center, MS: Naval Research Lab - Mapping Charting and Geodesy Branch. (DTIC No. ADA416769)

http://handle.dtic.mil/100.2/ada416769

Abstract: Geographical Information Systems (GIS) frequently store positional information in geographic coordinates (i.e., degrees of latitude and longitude). As a result, when GIS data are displayed on a video terminal, it is a usual practice to display the information "un-projected" with the view window x and y axis scaled in decimal degrees with degrees of longitude and latitude having the same scale factor on each axis. While this practice results in fast display time, avoiding the computational load imposed by complex cartographic projections, it results in a display that distorts the spatial relationships of the elements displayed on screen unless the displayed area is near the equator. A simple method is proposed as an alternative that greatly improves the display "fidelity" without adding any significant additional computational load.

Mitchell, D. K. (2003). *Advanced Improved Performance Research Integration Tool (IMPRINT) Vetronics Technology Test Bed Model Development (Report No. ARL-TN-0208)*. Aberdeen Proving Ground, MD: Army Research Lab. (DTIC No. ADA417350)

http://handle.dtic.mil/100.2/ada417350

Abstract: A researcher at the U.S. Army Research Laboratory built advanced improved Performance Research Integration Tool (IMPRINT) models of the U.S. Army Tank-Automotive and Armaments Command (TACOM) Vetronics Technologies Test Bed (VTT) soldier-machine interface (SMI) simulator. These models allow the TACOM system designers and contractors to determine a number of soldier-related issues without modifying the VTT SMI itself. Specifically, TACOM system designers and contractors can use these advanced IMPRINT models to determine which crew members should do which functions and tasks, as well as where automation would benefit the crew members, and optimum placement of controls and displays.

Neville, K., Fowlkes, J. and Strini, T. (2003). *Facilitating the Acquisition of Mission Planning and Dynamic Replanning Expertise*. Orlando, FL: CHI Systems Inc. (DTIC No. ADA416507)

http://handle.dtic.mil/100.2/ada416507

Abstract: Two current trends increasingly complex tactical teams and the growing demand for dynamic replanning have significant implications for mission planning and the ways in which it can best contribute to mission success. Effective mission planning can facilitate team coordination both during the relatively predictable phases of a mission and during more challenging mission events that require dynamic replanning or decision-making. However, it is hypothesized that aspects of mission planning expertise that facilitate team coordination during dynamic replanning and decision making are not exactly the same as those that support team coordination during more predictable mission phases. On the basis of this assumption, we proposed to develop the Cognition-Centered Constructivistic Program of Instruction (C3PI) as a means of facilitating the acquisition of those aspects of mission planning expertise that contribute specifically to the ability of a team to respond to dynamic, on-the-fly types of mission events. This Phase I effort involved research and development conducted for the purpose of developing a C3PI system design that is grounded in theory and research and consistent with the training needs and constraints of the operational user community.

Quester, A. O., Jareb, A. M., Lambert, W. B., Lee, G. and Kimble, T. H. (2002). *Manpower Critical Indicators Study (Report No. CRM-D0006494.A2)*. Alexandria, VA: Center for Naval Analyses. (DTIC No. ADA416491)

http://handle.dtic.mil/100.2/ada416491

Abstract: This study developed critical indicators for assessing the status and future health of Marine manpower. The first two overarching indicators address Marine Corps manpower requirements in terms of strength and the number of fully trained Marines. The next focuses on new Marines, comparing onboard Marines in their initial occupational training with requirements for the occupations. The fourth overarching indicator is the aviator inventory and its projection into the future. The last is a list of planned and actual completion dates for key inputs into the manpower process. The study also developed a series of critical indicators for the various subprocesses: recruiting, retention, attrition, and initial skill training. Previously, the Marine Corps could not monitor initial skill training. Now, with the database developed during the study, the Marine Corps can monitor initial skill training time by occupational specialty. Time awaiting training can be calculated as any actual training time that exceeds planned training time. Now the Marine Corps can calculate each month both the time to train and the time awaiting training at whatever aggregation level is appropriate. This entirely new manpower process indicator should be an important tool for those who hope to improve the efficiency of the manpower process.

Rogers, J. D. (2003). *Midshipmen Military Performance as an Indicator of Officer Fleet Performance.* Monterey, CA: Naval Postgraduate School. (DTIC No. ADA417081)

http://handle.dtic.mil/100.2/ada417081

Abstract: The United States Naval Academy is the premier source of officers for the Naval service. A Naval Academy diploma and commission into the Navy or Marine Corps requires a four-year total immersion into military culture, leadership training, and a demanding academic curriculum. The Naval Academy's unique style of leadership training prepares young men and women for service to their country is an artful combination of mental, physical, and emotional development processes. These processes culminate into a performance measure called the Military Performance grade. This research uses detailed literature reviews to support the operationalized model of the Naval Academy's midshipman development process. The model uses secondary data from the Bowman-Mehay data files for Naval Academy classes 1980 through 1985. Evaluated in this research are the outcomes of the Linear and LOGIT regressions of the fleet success measures of Officer Performance, Promotion, and Retention. This research indicates some surprising results about the role of academics, physical education, athletics, and the Military Performance grade on the development of future Naval officers. The Military Performance grade is consistently the best predictor of fleet success measures.

Shappell, S. A. and Wiegman, D. A. (2003). *A Human Error Analysis of General Aviation Controlled Flight Into Terrain Accidents Occurring Between 1990-1998 (Report No. DOT/FAA/AM-03/4).* Oklahoma City, OK: Federal Aviation Administration - Civil Aeromedical Institute. (DTIC No. ADA417230)

http://handle.dtic.mil/100.2/ada417230

Abstract: Although all aviation accidents are of interest to the Federal Aviation Administration (FAA), perhaps none is more disconcerting than those in which a fully functioning aircraft is inexplicably flown into the ground. Referred to as controlled flight into terrain (CFIT), these accidents continue to be a major safety concern within aviation, in particular general aviation (GA). A previous study as part of the FAA's Safer Skies agenda examined 165 CFIT accidents using root cause analysis and developed 55 interventions to address their causes. While the study represented the work and opinions of several experts in the FAA and industry, the findings might have benefited from a more detailed human error analysis involving a larger number of accidents. In this study, five pilot-raters independently analyzed more than 16,500 GA

accidents occurring between 1990-1998 using the Human Factors Analysis and Classification System (HFACS). Of the GA accidents examined, 1407 were identified as CFIT and compared with non-CFIT accidents using HFACS. The analysis revealed a number of differences in the pattern of human error associated with CFIT accidents. Findings from this study support many of the interventions identified by the CFIT Joint Safety Analysis Team (ISAT) and Joint Safety Implementation Team (JSIT), permitting safety professionals to better develop, refine, and track the effectiveness of selected intervention strategies.

Skelly, J. J., Jones, M. R., Goodyear, C. D. and Roe, M. M. (2000). *Attentional Pacing and Temporal Capture in Slow Visual Sequences (Report No. AFRL-HE-WP-TR-2003-0078).* Wright-Patterson AFB, OH: Air Force Research Lab - Human Effectiveness Directorate. (DTIC No. ADA417258)

http://handle.dtic.mil/100.2/ada417258

Abstract: Three experiments examined effects of temporally interleaved sequences of relevant and irrelevant information on selective attending to relevant visual items (letter pairs). In a serial monitoring task, viewers judged the physical match (same, different) of successive letter pairs in the relevant sequence under instructions to ignore irrelevant items. Irrelevant information comprised either visual information or tones. In all experiments the relative timing of relevant and irrelevant items was manipulated in slow visual sequences. Other manipulations included spatial formatting of irrelevant visual items (central vs displaced) and attentional set (speed vs accuracy). Results indicated that interleaved irrelevant information produced interference (slowed performance) relative to performance levels with relevant items alone only in certain timing conditions; in other conditions facilitation (faster responding occurred).

Xiao, Y., Seagull, F. J., Mackenzie, C. F., Klein, K. and Ziegert, J. (2003). *Distant Leadership Under Stress.* Baltimore, MD: University of Maryland. (DTIC No. ADA417104)

http://handle.dtic.mil/100.2/ada417104

Abstract: This project was initiated to develop a phenomenology of team leadership and distant leadership in a highly dynamic, potentially extremely stressful domain: trauma patient resuscitation. A series of five studies were conducted to understand team leadership in trauma teams. One of the studies was a field experiment in which the location of the team leader was assigned to a distant location connected to the rest of the team through telecommunication

linkages. The studies used a variety of qualitative and quantitative methods. In contrast to previous frameworks of leadership, the current project depicted detailed team leadership processes and structures critical to the success of action teams. These processes include adaptation of team structures in response to task urgency, team experience, and distance; the fluidity of leadership functions performed by various members of a team; and a multitude of leadership functions. The contribution of the project should be mainly in its depiction of the complex and fluid nature of team leadership for teams that are multi-disciplinary, highly learning oriented, and the hypothetical impacts of distance. The project laid out a new foundation for future research of team leadership in collocated as well as distributed teams.